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Potency of *Embilica officinalis* and *Nyctanthes arbor-tristis* against the damage caused by *Callosobruchus chinensis* (L.)

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ABSTRACT: Potency of *Embilica officinalis* and *Nyctanthes arbor-tristis* extracts, blended in the ratio of 1:1 (by volume), has been studied against the damage caused by *Callosobruchus chinensis*. The combination of the two plant extracts showed moderate potency against the damage caused by the pulse beetle. In the treatment group, the efficacy of the blended plant extracts seemed to be dose dependent since at 25%, 50%, 75% and 100% dose levels, the blended extracts showed 46.761, 54.574, 55.819 and 77.898 percent seed protection over control, respectively. The control group depicted only 11.68 percent seed protection.

KEYWORDS: Nyctanthes arbor-tristis, Embilica officinalis, seed protection.

I. INTRODUCTION

Pests are animals which cause economic loss due to increase in their population. The existence of these rather tiny creatures often clashes with the profit and welfare of human beings. Among the pests, the insects constitute a major group which as pests are able to cause significant harm to economic plants in many ways such as chewing of their part, sucking the cell sap, etc. Pulses and cereals are main staple food of people in India, stored by farmers who produce them followed by traders and government agencies in warehouses. These food items are infested by many species of stored grain insect pests. Several insects belonging to the orders coleoptera, diptera, heteroptera, homoptera, lepidoptera and orthoptera cause direct damage to crops, in the larvae and adult stages, and this predisposes crops to infections and diseases [1].

In order to keep the loss caused by the pests, many pest control practices evolved over the centuries. Cultural methods, physical control methods and use of inorganic compounds were the initial pest control strategies adopted by the farmers and other stakeholders. Later the discovery and use of synthetic organic compounds such as DDT and BHC initially seemed to be a major breakthrough in the field of pest management. However, the harmful effects of these chemical, both on environment and human health, resulted in the exploration of eco-friendly pest control practices.

The discovery of insecticidal properties of certain plant products drew attentions of the scientists to develop them as safer approach to the pest management. In many parts of the world, scientists are studying the toxic properties of plant products for their use as pesticides. Present investigation also deals with the investigation on the potency of blended extracts of *Embilica officinalis* and *Nyctanthes arbor-tristis* against *Callosobruchus chinensis* (L.)

II. MATERIAL AND METHODS

Rearing of experimental insect

In laboratory, the culture of *Callosobruchus chinensis* was developed and maintained in pre-sterilized jars containing disinfested cowpea seeds. The optimum condition of $27\pm 2^{\circ}\text{C}$ temperature and 60 ± 10 percent relative humidity was maintained. Freshly emerged adults (0-24 hrs) were taken for experimentation.

Collection and extraction of plant materials

Amla tree is a small to medium sized deciduous tree with an average height of 8-18 m. The fruits of this plant are depressed to globose shaped and fleshy, measuring 2.1-2.4 cm in diameter, 5.3-5.7 g in weight and 4.5-5.0 mL in volume. Splitting into three segments, the stone of the fruit is 6 ribbed [2]. *Nyctanthes arbor-tristis* is small terrestrial woody shrub with white flowers. This plant species can be cultivated in tropical and subtropical regions all over the world from sea-level up to 1500 m [3]. It has brown compressed, flat round or heart shaped capsules. The capsule

has two sections and the each section contains a single seed. Exalbuminous seeds are with thick testa and heavily vascularized outer layer of transparent cells. Cotyledons are flat with inferior radical [4].

Fruits of *Embilica officinalis* and Seeds of *Nyctanthes arbor-tristis* were thoroughly washed with water to remove the dust and dirt particles. Further, the plant materials were dried in shade and powdered with the help of an electric grinder. The extracts were prepared separately by Soxhlet extraction method [5] using acetone as solvent. 30 gm of powdered plant material was extracted with 300 ml of acetone keeping the ratio 1:10. The duration of extraction process was kept eight hours. After filtration, the extracts were kept in refrigerator as stock solution.

Experimental Design

After completion of the extraction process, the extracts of *Embilica officinalis* and *Nyctanthes arbor-tristis* were blended in the ratio of 1:1 (by volume). For experiments, 5 grams of cowpea seeds were taken in plastic vials and treated with 1 ml. of each desired dose level, i.e., 25%, 50%, 75% and 100%. The doses were prepared by mixing the extracts with respective volume of solvent. Three replicas of each dose level and a control containing seeds treated with solvent (acetone) only were run parallel. Three pairs of newly emerged adults (0-24 hrs. old) were introduced in each vial for egg laying on grains. The vials were covered with muslin cloth. Phagodeterrent action of the extract was assessed on the basis of average oviposition, average adult emergence, average loss in seed weight and percent seed protection. The number of eggs laid on seeds and the number of adults emerged were recorded. The loss in seed weight was calculated by weighing the damaged seeds separately. The number of unhatched eggs in each vial was calculated by direct observation and percent corrected egg mortality was calculated by following formula [6].

$$\% \text{ corrected mortality} = \frac{\% \text{ kill in treated} - \% \text{ kill in control}}{100 - \% \text{ kill in control}} \times 100$$

III. RESULTS AND DISCUSSION

Table 1 shows that upon treated with the different concentration levels of the blended plant extracts of *Embilica officinalis* and *Nyctanthes arbour-tristis* the oviposition potential of *Callosobruchus chinensis* was recorded to be 150.66, 132.33, 102 and 76 eggs at 25%, 50%, 75% and 100% dose levels, respectively however, the maximum egg laying (193.5 eggs) was observed in the untreated control group. The combination of two extracts posed moderate restrictive action against the hatchability of the eggs as it depicted 20.79, 26.19, 32.67 and 36.39 percent egg mortality at 25%, 50%, 75% and 100% dose levels, respectively as compared to 2.84 percent eggs observed to lose viability in the control group. Percent corrected egg mortality confirmed at four dose levels in ascending order was 18.47, 24.03, 30.70 and 34.53, respectively.

The joint action of two extracts extended percent seed protection to 80.48 at highest dose level as compared to 11.68 percent protection shown by the control group. However, 52.98, 59.88 and 60.98 percent seed protection was evident at 25%, 50% and 75% dose levels, respectively. Percent seed protection over control calculated was 46.761, 54.574, 55.819 and 77.898 at the four dose levels in the ascending order, respectively. In another study it has been recorded that the seed extract of *Nyctanthes arbor-tristis* when used unblended showed 85.078 percent seed protection over control at 100 percent dose level which shows that the combination of the extract with that of *Embilica officinalis* does not have significant improvement in terms of seed protection potency [7]. In a study scientist also evaluated a total of 7 plant materials viz., *Azadirachta indica*, *Piper nigrum*, *Ocimum tenuiflorum*, *Eucalyptus globules*, *Allium sativum*, *Pongamia pinnata* and *Litsea citrata* for their effect on oviposition reduction, adult emergence, infestation and weight loss by *C. chinensis*. The findings revealed the potential of *L. citrata* and *P. nigrum* as grain protectants against pulse beetle in storage [8].

Ground leaves, bark and seeds of *Aphanamixis polystachya* gave good protection for mung beans against pulse beetles [9]. In a study wheat and black eyed peas were applied with hexane extract of *Piper cubeba* berries and recorded reduction in infestation of 2 species of insect pests, viz., *Sitophilus oryzae* and *Callosobruchus maculatus* [10]. Efficacy of plant products as seed protectant was also studied by other scientists [11], [12]. The observations of these workers highlight the importance of exploration of plant products as safer alternative in the field of the pest management.

Table 01: Potency of *Embilica officinalis* extract blended with *Nyctanthes arbortristis* against *Callosobruchus chinensis*

S. No.	Dose level	Fecundity	% egg mortality	% corrected egg mortality	% grain damage	% seed protection	% seed protection over control
1.	25%	150.66	20.79	18.47	47.02	52.98	46.761
2.	50%	132.33	26.19	24.03	40.12	59.88	54.574
3.	75%	102	32.67	30.70	39.02	60.98	55.819
4.	100%	76	36.39	34.53	19.52	80.48	77.898
5.	Control	193.50	2.84	-	88.32	11.68	-

Weight of treated cowpea seeds – 5 grams

Number of replications – 3

Number of adults in each replication – 6 (3 males + 3 females)

IV. CONCLUSION

The combination of *Embilica officinalis* and *Nyctanthese arbor-tristis* extracts in the ratio of 1:1 showed moderate potency against the damage caused by the pulse beetle. In the treatment group, the efficacy of the blended plant extracts seemed to be dose dependent since at 25%, 50%, 75% and 100% dose levels, the blended extracts showed 46.761, 54.574, 55.819 and 77.898 percent seed protection over control, respectively.

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